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How Economic Findings Can Inform Prevention Research in Cardiovascular Disease

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A companion commentary by Wang et al.[1] summarizes recent analyses at the Centers for Disease Control and Prevention of the economic burden of cardiovascular disease (CVD) and of the cost effectiveness of interventions targeting hypertension and CVD. The purpose of this editorial is to consider how researchers and policy makers can use such findings to inform prevention efforts.

Cost-of-illness estimates are commonly generated to call attention to the economic burden of various diseases and health risk factors (e.g., smoking) and the potential economic gains from prevention.[2] Hypertension is both a disease and a risk factor for other CVDs. Even slight variations in the methods used can produce different cost-of-illness estimates. The methodologic choices include whether estimates are incidence-based or prevalence-based; to what extent they control for covariates (e.g., comorbid conditions); the sources of data; types of costs included; and the analytic perspective.[3]

Most published cost-of-illness estimates are prevalence-based, meaning that they are estimates of costs for the prevalent population affected by disease in a given year. Such estimates allow one to project the potential cost savings under the counterfactual scenario that the prevalent cases of disease had never occurred. In contrast, incidence-based cost-of-illness estimates calculate the present value of attributable costs in both current and future years for a cohort of incident cases, including costs associated with disease complications and sequelae. The present value of costs of an incident case is calculated by multiplying annual attributable costs for disease stratified by age in years or years since onset by life table survival probabilities and discounting to the present. Such estimates can be used to project cost savings from the prevention of new cases of disease in cost-effectiveness analyses (CEAs) of prevention strategies. All five original cost-of-illness analyses reported in this supplement are prevalence-based[4–8] and are appropriate for use in raising awareness of the economic burden of hypertension and CVD.

Most cost-of-illness estimates for chronic disease are the outputs of regression models that control for various covariates, including comorbidity. Deciding which comorbid conditions

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should be controlled in a given analysis depends on the study question. For analyses of disease-attributable cost excluding comorbid conditions that are downstream in the causal pathway (i.e., conditions for which the disease is a risk factor) avoids underestimating the economic burden. Thus, for example, an analysis of hypertension-related costs among adults with diabetes by Wang and colleagues[6] treated stroke and heart disease as complications of hypertension rather than as comorbid conditions to be controlled as covariates. In contrast, an analysis by Park et al.[5] of medical expenditures for people with hypertension included the number of comorbid diagnoses as covariates because the purpose was to understand how costs among people with hypertension vary based on the number of relevant diagnoses.

Almost all U.S. cost-of-illness analyses use expenditure data to estimate medical costs. Insurance claims data can be used to estimate costs for specific payers (e.g., Medicaid or Medicare), or payer type (e.g., employer-sponsored health plans), and population survey data, in particular the Medical Expenditure Panel Survey, is used to estimate expenditures for all payers. All four original cost-of-illness analyses of medical costs used Medical Expenditure Panel Survey data to estimate all-payer mean expenditures.[5–8] A literature review by Chapel and colleagues[9] of cost-of-illness estimates for Medicaid-enrolled working-age adults with chronic conditions found that most published studies used Medicaid claims data, with only a few using Medical Expenditure Panel Survey data.

The cost-of-illness study by Joo et al.[4] used survey data from the Health and Retirement Study on reported hours of informal caregiving time to estimate the economic burden of caregiving associated with falls and stroke in the elderly. The economic value of informal caregiving time, mostly provided by family members, is a large part of the economic cost of many chronic, disabling conditions. Since 1996, U.S. guidelines have called for the inclusion of informal caregiving costs as direct costs in societal-perspective CEAs.[10] There is no consensus, though, on how to estimate the economic value of caregiver time. A replacement cost method using average wages of home aides, as was done by Joo et al., can underestimate costs if it excludes payroll taxes and fringe benefits.[11] The opportunity cost approach, which values caregiver time based on age- and sex-specific average earnings,[12] can yield either higher or lower estimates of costs depending on the earning potential of the caregiver population.

Four articles address economic evaluations of interventions targeting hypertension and CVD.[13–16] In a systematic review of CEAs of antihypertensive medications, Park and colleagues[14] found that cost-effectiveness ratios were consistently <$20,000 per quality-adjusted life-year (QALY) saved; many were negative, meaning that their use may be cost saving (i.e., lower total healthcare costs). Estimates of incremental cost-effectiveness ratios across different classes of medications were also reviewed, but those estimates are sensitive to assumptions about drug price, which vary across countries and years. Zhang et al.[16] reviewed economic estimates of hypertension educational, self-monitoring, and screening interventions and found consistent evidence of cost savings or low cost-effectiveness ratios for educational interventions supporting medication adherence.

Chattopadhyay and colleagues[15] summarized estimates from Community Guide systematic reviews of specific strategies: team-based care, reduced out-of-pocket costs, clinical decision

support systems, value-based insurance design, self-monitoring of blood pressure, and community health workers. The independent Community Preventive Services Task Force categorizes interventions that cost <$50,000 per QALY as cost effective. Using this threshold, the reviews found evidence of cost effectiveness for team-based care and for self-monitoring of blood pressure when accompanied by patient support or team-based care. It should be noted that the U.S. DHHS does not endorse any particular cost-effectiveness threshold; it is up to decision makers to decide whether an intervention's return justifies the cost of implementation given their specific objectives and resource constraints. The Community Guide reviews noted that for some interventions there was mixed evidence (conflicting findings) and for others there was no evidence relating to cost effectiveness. The major contribution of the article by Chattopadhyay is its comprehensive summary of the evidence gaps and challenges to demonstrating that public health interventions improve health outcomes at an acceptable cost.

An original CEA by Joo et al.[13] modeled how the cost effectiveness of using intravenous recombinant tissue plasminogen activator for treating acute ischemic stroke within 3-4.5 hours after onset of stroke can vary by age group (18–44, 45–64, 65–80, and ≥81 years). The analysis took the U.S. healthcare sector perspective in which only medical costs are considered. For patients aged <65 years, the treatment was found to be cost saving; for older adults, point estimates of the incremental cost-effectiveness ratio were <$50,000 per QALY. These findings are consistent with previous non–age-stratified CEA estimates and also with existing recommendations that all acute stroke patients be treated, regardless of age. However, the cost-effectiveness conclusion is not robust for very elderly stroke patients; the cost exceeded $50,000 per QALY in roughly half of the simulations for the group aged >80 years, as well as exceeding $100,000 per QALY in one quarter of simulations. In any case, these thresholds are arbitrary and are often exceeded for widely used clinical practices.[17,18] Conducting a CEA can be very challenging because of gaps in evidence on model parameters, and the assumptions adopted in this study, like others, can be questioned.

The scope of health economics extends beyond assessing economic costs associated with conditions or calculating the costs avoided through prevention. Health economists also use multiple quantitative research methods to evaluate health interventions and policies. One article in this supplement falls in that category. Fang and colleagues[19] used survey data from 2006–2009 to 2011–2014 to assess trends in indicators of barriers to access health care by young adults aged 19–25 years in general and by those with hypertension. Previous studies have demonstrated reduced barriers to access by young adults with the adoption of the dependent care provision of the Patient Protection and Affordable Care Act.[20] This study reported results consistent with previous findings for young adults overall and also observed similar findings for young adults with hypertension. Reducing barriers to care is particularly important for people with chronic conditions.[20]

We believe that the papers in this supplement provides researchers and policy makers with critically important information about the costs of hypertension and CVD and related interventions and that this information can help inform prevention efforts.

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